

# Ultra Low-Level Counting for National Defense at the Proposed National Underground Science Laboratory

Thomas J. Bowles  
Los Alamos National Laboratory

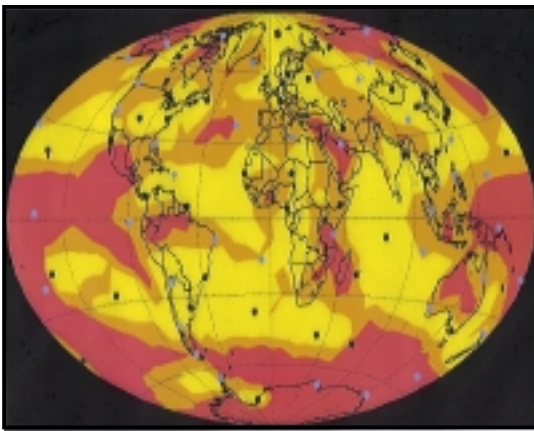
## Applications to National Defense

### New Security Issues

- Environmental Security
  - Nuclear Terrorism
  - Nuclear Accidents
  - Foreign Nuclear War
- Domestic Nuclear Event
  - Consequence Mitigation
  - Population Protection
  - Attribution
- Law Enforcement
  - Nuclear Smuggling
  - Nuclear Forensics

### Resurgent Security Issues

- Nuclear Treaty Monitoring
  - Weapons Test Moratorium
  - Threshold Test Ban Treaty
- Future treaties & agreements
  - Potential Bilateral Nuclear Test Limitations & Agreements



### CTBT Xe Monitoring Network

- CTBT would use a network of 40 Xe monitoring stations
  - Provides required sensitivity for seismically muffled tests
  - Coverage is shown for projected sensitivity for 1 kt device detonated underground yielding 1mBq/m³ of airborne Xe isotopes, providing 58.2% global coverage.
- Sensitivity levels: ■ 0 - 0.04 ■ 0.4 - 0.75 ■ 0.75 - 1.0
- Sampling for different gases can provide sensitivity for other nuclear-related activities in environmental security.
- All such measurements would benefit substantially from more sensitive detection of the isotopes of interest.

## Proposed Ultra Low-Level Counting Facility NUSL at Homestake

- Minimizing Backgrounds
  - A deep underground location
  - Sulphurcrete and water shielding
  - Radon-free air
  - Ultra-pure liquid nitrogen
  - Radon-free nitrogen gas
  - Low activity materials
  - Water / scintillator purification

- Detector Systems
  - Low background HPGe systems
  - Alpha-beta surface counting
  - Ar, Kr, Xe, Rn, ... counting
- An ultra-pure water shielding pool
  - Ultra-sensitive gamma counting
  - Prototyping new detectors
- Common infrastructure

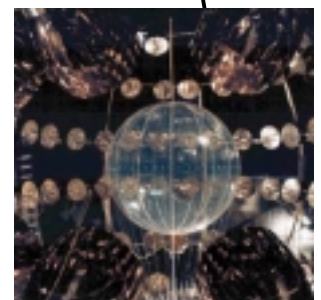
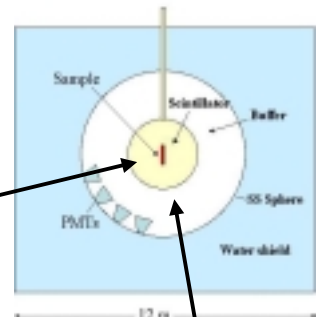
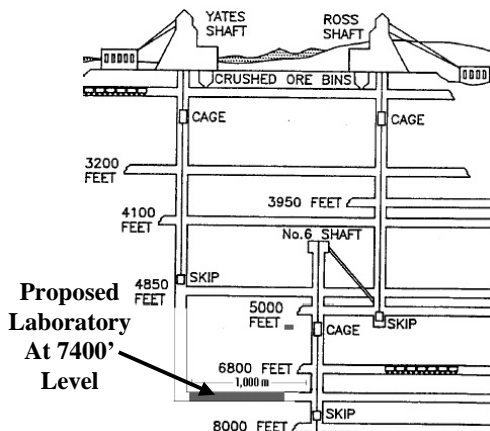


Photo from Borexino  
Counting Test Facility



- Proposed ultra low-level counting facility would provide factor of 10-100 improved sensitivity.
- Allows reduction in sample size and time constraints for counting short-lived isotopes.
- Provides greater flexibility in monitoring for activities that impact our national security.